Developing Questions to Teach a Mini-Lesson

Topic: Bohr Diagrams (Grade 9, Academic Chemistry: Atoms, Elements and Compounds)

Prior Knowledge:

* The differences between protons, neutron and electrons (mass, charge)
* The previously accepted atomic model by Thomson (chocolate chip cookie model)
* An understanding of how to obtain information about the number of protons, neutrons and electrons based on the atomic number and atomic mass

Teaching Goals For This Lesson:

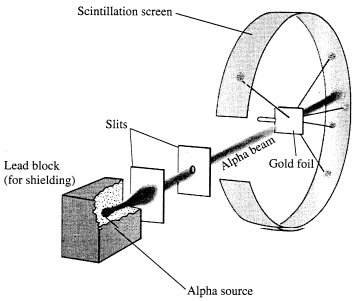
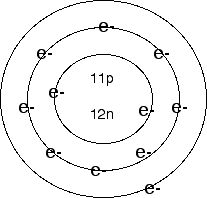
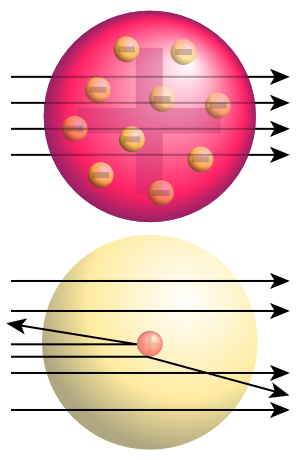
* Review the characteristics of subatomic particles
* Review how atomic number and atomic mass help determine the number of respective subatomic particles
* Review the ‘chocolate chip cookie’ atomic model
* Introduce the Ruther-ford’s gold-foil experiment and evidence to disprove Thomson’s theory
* Introduce the Bohr-Rutherford diagram as it’s currently accepted
* Explain how to draw Bohr-Rutherford diagrams for elements on the periodic table

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| **Number** | **Cognitive Level (K, A, HOTS)** | **Question** | **Expected Answer** |
| *1* | *K* | *List the first words that come to mind when I say the word ‘PROTON’ (Neutron, Electron)* | *Small*  *Positively charged*  *Subatomic particle* |
| *2* | *K* | *What does the atomic number of an atom represent?* | *Number of Electrons* |
| *3* | *K* | *Hydrogen, Carbon, Oxygen, Chlorine (on own)– As a class, list the respective numbers of protons, neutrons, electrons* | *Hydrogen (1p,1e)*  *Carbon(6p, 6e, 6n)*  *Oxygen (8p, 8e, 8n)*  ***Chlorine (17p, 17e, 18n)*** |
| *4* | *A* | *A hypothetical element has atomic number 121 and atomic weight 249. How many of each subatomic particle does it have?* | *Protons 121*  *Electrons 121*  *Neutrons 128* |
| *5* | *K* | *When Thomson proposed the first atomic model, he based it on which of these subatomic particles?* | *Electrons* |
| *6* | *K* | *Can anyone remember what they were called at that time?* | *Corpuscles* |
| *7* | *A* | *Using this chocolate chip cookie as a metaphor, how did Rutherford describe the organization of the atom?* | *Electrons as chocolate chips, the rest of the cookie as a homogeneous, positively charged jelly like distribution to cancel negative electrons* |
| *8* | *A* | *Why must the ‘rest’ of the cookie be positively charged?* | *To counteract the negatively charged electrons to form a neutral atom* |
| 9\*New Material | \*Introduce Rutherford gold foil experiment\*  HOTS | Given the previously accepted model, what would you expect the alpha particles to do when they pass through the atom? | Bounce off the chocolate chips?  Go straight through? |
| 10 | \*Provide results of gold-foil experiment\*  HOTS | What can we infer based on the experimental results about the organization of the atom? | Unequal  Concentration in the centre  Mainly empty space |
| 11 | \*Introduce Rutherford’s model, explaining that protons and neutrons are concentrated in the nucleus with electrons orbiting around  HOTS | What does this model resemble? Hint: orbit? | Planetary system |
| 12 | HOTS | Planets are fixed in their orbit, do you think electrons are also fixed as they move around the nucleus? | No. Electrons are small particles that behave like light waves. It’s impossible to predict their location. |
| 13 | HOTS | Why are there are a fixed number of electrons each orbital can accommodate? | Electrons repel and the orbitals closest to the nucleus cover a smaller area and can’t accommodate |
| 14 | A | Which element is represented by this Bohr model? | Na (Sodium) |

Future Activities

* Practice drawing Bohr diagrams for various elements

Visuals (to be drawn on board)



Reflective Summary

I found this assignment challenging for many reasons. First, attempting to develop a lesson plan for students without knowing where the specific topic fit into the course a whole was difficult. I was uncertain of the previous knowledge of the students. Furthermore, basing this lesson on a figure from the module left me with many questions regarding the content of the lesson. Using my selection, the Bohr diagram of the chlorine atom, as an example, I was torn between focusing on background knowledge including the atomic theory or a more application-based lesson on how to draw Bohr-diagrams. In spite of my confusion regarding this assignment, I did receive many points of positive feedback.

My evaluating partner first commented on the positive energy I exuded while delivering this lesson. My students are of course, more likely to be interested in a lesson if I, as the teacher, am also interested! My partner also mentioned that I asked good, thought-provoking questions in a logical sequence. He felt that the visuals I chose assisted in student understanding of the given topic.

In terms of negative feedback, I am in fact my worst critic. I felt that I attempted to include too much information into a short, ten-minute lesson. Furthermore, I should have asked more generalized questions in order to gain an understanding of students’ prior knowledge. Although the visuals I chose were suitable, I thought using a time-line to introduce the evolution of the atomic theory, would have catered to wider variety of learning styles. Additionally, some of the concepts I introduced during this lesson were difficult to understand. Incorporating metaphors into the lesson, as suggested by my evaluating partner, would have been a great addition.

Overall, I enjoyed this activity. It encouraged me to reflect on my own teaching styles; something I hope to continue to do throughout my career. This activity gave me the opportunity to review some of the Grade 9 science curriculum and build confidence teaching in front of an audience.